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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/809,974	03/26/2004	Shang-Chih Chen	67,200-1258	7904

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TUNG & ASSOCIATES
Suite 120
838 W. Long Lake Road
Bloomfield Hills, MI 48302

EXAMINER	
QUACH, TUAN N	
ART UNIT	PAPER NUMBER
2826	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	12/20/2006	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/809,974	CHEN ET AL.	
	Examiner	Art Unit	
	Tuan Quach	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *25 September 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *22-42* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *22-42* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *26 March 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Tuan Quach
Primary Examiner

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

This application presents a claim for subject matter not originally claimed or embraced in the statement of the invention. This corresponds to the recitation regarding the oxygen containing buffer and the recitation regarding reduced metal diffusion across a high-K dielectric interface as now amended in claims 22, 41, 42. Compare, e.g., instant disclosure, [009]. A supplemental oath or declaration is required under 37 CFR 1.67. The new oath or declaration must properly identify the application of which it is to form a part, preferably by application number and filing date in the body of the oath or declaration. See MPEP §§ 602.01 and 602.02.

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 22-29, 31-35, 39-42 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Li or Chen.

Re claim 22 and 42, Li (2005/0202659) teach a gate structure comprising a high k dielectric layer 56 disposed over semiconductor substrate 42, a buffer dielectric layer 58 on the high k dielectric layer 56, a gate electrode layer 60 on the buffer dielectric layer 58. Note that the oxygen containing buffer layer 58 is taught at [0046], wherein the doping of layer 58 and 56 with oxygen, e.g., by implantation is taught. See Figs. 1 and 12, [0027]-[0031]. Chen 2005/0269651 also teaches high K dielectric 32 over semiconductor substrate 31, buffer dielectric 33/34 on the high K dielectric layer, including metal, silicon or nitrogen dopant. See [0014]-[0084], Figs. 2 and 3. Note that the buffer dielectric including oxygen is also taught, [0039], [0040], [0088], [0141], claims 22, 28, and 29. The use of interfacial layer is also taught. [0080].

Note that re claim 25 and 42, the material of the buffer dielectric layer comprising dopants selected from the group consisting of a metal, a semiconductor, [and nitrogen,

now deleted], such is met by materials for the buffer dielectric disclosed in Li, e.g., [0030], including various nitrogen compounds such as SiN, AlN, etc, and in Chen above, including [0084].

Re claims 23-24, as well as the preamble of claim 22, 41, 42, the voltage threshold being reduced and reduced metal diffusion would follow given the same materials of buffer dielectric is taught by Li or Chen; additionally, while features of an apparatus may be recited either structurally or functionally, claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. In re Schreiber, 128 F.3d 1473, 1477-78, 44 USPQ2d 1429, 1431-32 (Fed. Cir. 1997) (The absence of a disclosure in a prior art reference relating to function did not defeat the Board's finding of anticipation of claimed apparatus because the limitations at issue were found to be inherent in the prior art reference); see also In re Swinehart, 439 F.2d 210, 212-13, 169 USPQ 226, 228-29 (CCPA 1971); In re Danly, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). "[A]pparatus claims cover what a device is, not what a device does." Hewlett-Packard Co. v. Bausch & Lomb Inc., 909 F.2d 1464, 1469, 15 USPQ2d 1525, 1528 (Fed. Cir. 1990) (emphasis in original). A claim containing a "recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus" if the prior art apparatus teaches all the structural limitations of the claim. Ex parte Masham, 2 USPQ2d 1647 (Bd. Pat. App. & Inter. 1987).

Re claim 25, the inclusion of an interfacial dielectric is also taught in Li, layer 54, [0028], in Chen [0084]. Re claim 26, the various silicon oxide/nitride for the interfacial

materials is also taught in Li [0028] and Chen above; additionally, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials. Re claim 27, the buffer dielectric being greater than 3.9 would be met given the materials disclosed above, e.g., SiN, AlN in Li and corresponding materials in Chen which has dielectric constant greater than that of silicon oxide. The various silicon materials in claims 28, 29 are taught in Li [0030] and in Chen above. Re claims 31 and 32, the dielectric including oxides or nitrides, is also met, e.g., aluminum nitrides as taught above. Re claims 34, 35, the metal dopant of Al is taught in Li above; the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Re claims 39 and 40, the high k dielectric materials being enumerated are also taught in Li, [0029] and Chen above. In any event, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claim 30 rejected under 35 U.S.C. 103(a) as being unpatentable over Li or Chen as applied to claims 22-29, 31-35, 39-42 above, and further in view of Adetutu.

Adetutu 2005/0085092 teach concentration gradient in the dielectric layer to prevent unwanted diffusion. See abstract, [0013]-[0033].

It would have been obvious to one skilled in the art to have employed the suitable concentration gradient wherein such is conventional and advantageous to prevent unwanted diffusion as taught by Adetutu.

Claims 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Li or Chen as applied to claims 22-29, 31-35, 39-42 above, and further in view of Kim and Xiang.

The reference as applied above does not recite PMOS and NMOS, e.g., in CMOS devices.

Kim 6,727,130 teach dielectric materials including Al203, HfO2 employed in gate insulating layer for formation of PMOS and NMOS device. See column 56 line 62 to column 6 line 18.

Xiang 6,734,527 also teaches CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their applications in MOS devices including NMOS and PMOS devices. See column 4 line 7 to column 6 line 37.

It would have been obvious to one skilled in the art in practicing the above invention to have employed the respective and suitable materials including hafnium oxide and aluminum oxide in NMOS and PMOS devices since such application is conventional and advantageous as evidenced by Kim and Xiang wherein desired dielectric constant for the particular devices can be obtained.

Claims 22-24, 27-29, 31-32, 34, 35, 36, 39, 40, 42 rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Bojarczuk.

Re claims 22 and 42, Bojarczuk (2002/0190302) teaches a gate structure comprising a high-k gate dielectric layer 220 disposed over a semiconductor substrate 210; a diffusion barrier 230 (corresponding to applicant's buffer dielectric layer comprising dopants selected from group consisting of metal, semiconductor, and (nitrogen, now deleted) on the high k gate dielectric layer; and a gate electrode layer 240 on the buffer dielectric layer. The claimed material of the buffer dielectric is met, given the materials taught for layer 230, including nitride compounds such as aluminum nitride and silicon nitride. See [0029]-[0042]. Note that for the newly added limitation regarding oxygen containing buffer, such is taught, [0038], claims 4, 6, 14, 16. Re the recited reduced voltage, e.g., claims 23, 24, 42, etc., the reduced voltage and reduced metal diffusion would result, absent evidence to the contrary, as the buffer dielectric or diffusion barrier 230 is present, including similar material taught in the applied prior art. Such functional language would be deemed to be unpatentable as delineated above wherein the structural limitations are met. Re claim 27, the buffer dielectric constant being greater than 3.9 would be met given the materials such as aluminum nitride and silicon nitride are taught. Re claim 28, the buffer dielectric comprising non-metal containing dielectric selected from the group consisting of metal oxide, semiconductor nitride, oxides, nitrides, and silicates, is met given the teachings of Bojarczuk, [0038], wherein materials such as silicon oxynitride, silicon nitride, aluminum nitrides, are taught. Re claim 29, wherein buffer dielectric layer comprising nitrogen doped dielectric selected from the group consisting of silicon nitrides, silicon oxynitrides, silicate nitrides, silicate oxynitrides, is met over the teachings of Bojarczuk as delineated above re claim

28. Re claims 31, 32, 34, 35, 39, 40, wherein the buffer dielectric comprising a dielectric including metal dopants is met over the teachings of Bojarczuk, [0038] wherein metal dopant such as aluminum is taught. In any event, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claims 25, 26, 41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Green.

Although Bojarczuk does not explicitly recite the use of interfacial layer under the high k dielectric in these claims, Green 2005/0042846 A1 teaches the use of aninterfacial layer under the high k dielectric layer to facilitate the growth of the high k dielectric and to provide good electrical interface and low interfacial state density. See Fig. 2B, [0006], [0010].

It would have been obvious to one skilled in the art in practicing the above invention to have included the interfacial layer since such is conventional and advantageous as evidenced by Green. The selection of well known interfacial materials in claim 26 for such purpose is conventional and well within the purview of one skilled in the art and as such would have been obvious. Alternatively, official notice is given regarding the use of such conventional alternative materials for the interracial layer.

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Adetutu.

Adetutu 2005/0085092 teach concentration gradient in the dielectric layer to

prevent unwanted diffusion. See abstract, [0013]-[0033].

It would have been obvious to one skilled in the art to have employed the suitable concentration gradient wherein such is conventional and advantageous to prevent unwanted diffusion as taught by Adetutu.

Claims 31-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Paton and Chen.

Regarding the alternative of various metal dopants, in addition to the teachings of Bajarczuk delineated above, such would have been obvious given the teachings of Paton, column 10 line 1 et seq. and Chen as delineated above, see [0014]-[0084], Figs. 2 and 3. Additionally, the enumeration of various alternative and suitable materials would have been conventional and obvious for the recited purpose and well within the purview of one skilled in the art; alternatively, official notice is given regarding the conventional recitation/use of such materials.

Claims 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bojarczuk in view of Kim and Xiang.

The reference as applied above does not recite PMOS and NMOS, e.g., in CMOS devices.

Kim 6,727,130 teach dielectric materials including Al203, HfO2 employed in gate insulating layer for formation of PMOS and NMOS device. See column 56 line 62 to column 6 line 18.

Xiang 6,734,527 also teaches CMOS devices including gate materials such as hafnium silicates, aluminum oxide and their applications in MOS devices including

NMOS and PMOS devices. See column 4 line 7 to column 6 line 37.

It would have been obvious to one skilled in the art in practicing the above invention to have employed the respective and suitable materials including hafnium oxide and aluminum oxide in NMOS and PMOS devices since such application is conventional and advantageous as evidenced by Kim and Xiang wherein desired dielectric constant for the particular devices can be obtained.

Applicant's arguments filed September 25, 2006 have been fully considered but they are not persuasive.

Initially, see the new grounds of rejection delineated above. Addtionally, regarding the advantages concerning the threshold voltage on page 16 of the remarks, note that the voltage threshold shift is with regard to a prior art that does not employ buffer, this is in applicable to the rejections wherein all the prior art employs buffer layer therefore the advantages associated would follow as the original disclosure evidences that the buffer layer would result in improve device performance and therefor such advantages would follow from the prior art as well.

With regard to Chen, note that the parent application thereof has filing date of Dec. 9, 2003 while the instant application which has an effective date of March 26, 2004. It remains that the claimed invention in the instant application has been known by others prior to the date of invention of this application.

With regard to Li and Bojarczuk, applicant's arguments fail to comply with 37 CFR 1.111(b) because they amount to a general allegation that the claims define a patentable invention without specifically pointing out how the language of the claims

patentably distinguishes them from the references. Applicant argues that Li and Bojarczuk teach the use of a buffer that defeats the purpose and operation. Initially, note that the broad support from the instant disclosure that the use of a buffer layer would result in improve device characteristics, and not a particular material. Clearly applicant has provided support that the buffer if present would result in improved device characteristics. As evidenced by applicant's own disclosure, a wide recitation of numerous materials would result in the advantages alleged. Applicant has failed to provide any evidence the buffer and structures employed in prior art would not result in a reduced threshold voltage shift or reduced metal diffusion while the original disclosure evidences that the use of the buffer would result in such improvement.

Applicant further argues regarding it rejects the official notice given regarding claims 34, 35, 39, 40. This support that a wide materials can be employed as the buffer material and high k dielectric layer in question and the lack of criticality of a specific material. The enumeration of the numerous materials in these claims is fully anticipated by the prior art and in any event would not require any inventiveness or unobviousness.

Regarding Adetutu, applicant argues that this would change the principle of operation and make it unsuitable for its intended purpose. This however overlooks the teachings of Adetutu, wherein concentration gradient in the dielectric can be employed to prevent unwanted diffusion. It remains that such use of be suitable for the intended purpose, namely to improve diffusion barrier characteristics.

Regarding Kim and Xiang, applicant argues that there is no prima facie case of obviousness. This however overlooks the teachings in Kim and Xiang regarding the

application in PMOS and NMOS regarding materials including AI203, HfO2 employed in gate insulating layer for formation of PMOS and NMOS device wherein desired dielectric constant for the particular devices can be obtained.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Tuan Quach
Primary Examiner